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Effects of particulate materials and osmoprotectants on very-high-gravity ethanolic fermentation by *Saccharomyces cerevisiae*.

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The effects of osmoprotectants (such as glycine betaine and proline) and particulate materials on the fermentation of very high concentrations of glucose by the brewing strain *Saccharomyces cerevisiae* (uvarum) NCYC 1324 were studied. The yeast growing at 20 degrees C consumed only 15 g of the sugar per 100 ml from a minimal medium which initially contained 35% (wt/vol) glucose. Supplementing the medium with a mixture of glycine betaine, glycine, and proline increased the amount of sugar fermented to 30.5 g/100 ml. With such supplementation, the viability of the yeast cells was maintained above 80% throughout the fermentation, while it dropped to less than 12% in the unsupplemented controls. Among single additives, glycine was more effective than proline or glycine betaine. On incubating the cultures for 10 days, the viability decreased to only 55% with glycine, while it dropped to 36 and 27%, respectively, with glycine betaine and proline. It is suggested that glycine and proline, known to be poor nitrogen sources for growth, may serve directly or indirectly as osmoprotectants. Nutrients such as tryptone, yeast extract, and a mixture of purine and pyrimidine bases increased the sugar uptake and ethanol production but did not allow the population to maintain the high level of cell viability. While only 43% of the sugar was fermented in unsupplemented medium, the presence of particulate materials such as wheat bran, wheat mash insolubles, alumina, and soy flour increased sugar utilization to 68, 75, 81, and 82%, respectively.

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